DOOSAN Document Transmittal

Upper Trishuli-1 HEP (216MW)

Date	DT No.:	SHEET
2022-07-17	UT1-HEP-DHI-PC-D-0045	1 OF 1

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SUBJECT	Submission of Review Note RN-0178, RN-0180, RN-0181 and RN-0182		

S. N.	REVIEW NOTE NO.	REVIEW STATUS	DWG. / DOC. NO.	REV.	DWG. TITLE / DOC. DESCRIPTION	REMARK
1	RN-0178	RR	UT1-C-010-CVL-DC-42005	0C	Structural Calculation of Diversion Tunnel Lining	
2	RN-0180	AN	UT1-C-030-CVL-OT-52001	0	Review Report of UT-1 HEP Desander Basin Model Test	
3	RN-0181	AN	UT1-C-030-CVL-DC-52002	0	Procedure for NA for Sediment Deposition and Flushing of the DB	
4	RN-0182	RR	UT1-C-010-CVL-DG-42006	0C	Reinforcement Drawing of Diversion Tunnel Lining	
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Legend of Review Status
A : APPROVED
AN : APPROVED AS NOTED
RR : RETURN FOR RESUBMISSION
FI : FOR INFORMATION

DHI STAMP

Doosan Enerbility Co., Ltd
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Discipline : Civil

UPPER TRISHULI-1 HEP (216MW)

Client	**Nepal Water and Energy Development Company Private Limited**
Owner's Engineer	**Tractebel Engineering GmbH / Jade Consult**

REVIEW NOTE

Contractor	**Doosan Enerbility**		
Title of the Document	Review Report of UT-1 HEP Desander Basin Model Test		
Document No.	UT1-C-030-CVL-OT-52001	Revision	0
Date of Documents	07.07.2022	Received Date	08.07.2022
Transmittal Form No.	UT1-HEP-DHI-D-0292		
Previous Review Date/Status	N/A	Prev. Review Note No.	N/A
Review Note No.	**RN-0180**	**Present Review Date**	**16.07.2022**
		Present Review Status	**AN**

A: Approved AN: Approved as Noted RR: Returned for Resubmission FI: For Information, only

Requirements quoted from EPC Contract (reminder only)**:**

- ***ANNEX 13, Employer´s Requirements, Part B, Design Requirement (1. Main Body)***

J. The desander chambers shall be designed for 90% removal of over the 0.2 mm sediment particles.
K. The average horizontal flow velocity in the desander chambers shall be 0.2 m/s.

- ***ANNEX 13, Employer´s Requirements, Part A Project Construction Requirements*:**

D. The desander chambers shall be designed for 90% removal of 0.2 mm and larger diameter sediment particles to minimize turbine damage.
E. The average horizontal flow velocity in the desander chambers shall be 0.2 m/s.

Comments:

- A professional third party review of the model study, the study which had been carried out by the Contractor.
- Sediment data are limited to two measuring campaigns during the monsoon seasons 2010 and 2012, with results varying substantially. Therefore, no representative sediment size and particle size distribution can be defined with sufficient accurancy and reliability. However, the OE agrees with the statement that data observed for 2010 are to be considered – if not unrealistic – at least not representative.
- Sediment concentrations are different during different seasons, floods and between floods. This will result in different sedimentation pattern in the basin, and different representative sediment concentrations should be investigated.
- What is the correct interpretation of the contractual requirement for sediment removal (see Annex 13, Part B, point J, and Annex 13, Part A, point D)? That has a legal aspect, and there is a technical aspect. The review report tends to address the technical aspect aiming at a better performance of the hydropower plant by stating that the desander basin design should aim at settling diameter d = 0.20 mm as the lower limit rather than artificially increasing the settling efficiency by mixing different fractions into one – higher - settling efficiency.

- The settling efficiency achieved in the model study (>90%) is ignoring the adverse flow conditions with high flow velocities well above 0.2 m/s at the bottom of desander as shown in the documentation of the study. The OE agees with the conclusion that therefore the recommended dimensions, particular the length of the basin are insufficient to achieve a 90% removal of the 0.20 mm grain size.
- There are more than one approaxch to calculate the settling process (e.g. Camp, Vetter, Hazen, etc.) with a wide range of results as shown by Hydro Lab.
- The scaling of particles of different sediment size has not been considered and translated appropriately into the physical model. The OE agrees with Hydro Lab's finding that this may have significantly distorted the settling results obtained.
- OE's Observations on the 'Recommendations' given in the 'Review Report' by Hydro Lab:
    - Use sediment data of 2012 ⇨ OE agrees (if no other data can be made available, e.g. during the current monsoon season).
    - Use the physical model to measure flow velocities and distribution ⇨ OE agrees.
    - Use measured results from physical model for calibration of numerical model ⇨ OE agrees.
    - Carry out simulations of modifications in numerical model and confirm later in physical model ⇨ OE agrees.
    - Adjust model sediment ⇨OE agrees.
    - Physical model tests to determine settling efficiency ⇨ OE has reservations to the applicability and transferability of quantative results on the prototype; for qualitative comparisions anytime accepted.
    - A numerical modell is proposed ⇨ OE agrees.
    - Study operational scenarios of the desanding basins. ⇨ OE agrees.

Aditional comments regarding EPC Contractor´s presentation of "Desander Basin Design Change", held on Thursday, 7th of July 2022 in presence of EMP and OE:

- A third party review, ie. by an external adviser to the Contractor is considered positive by the OE.
- The OE shares the statement of the reviewer recommending the width over height ratio of 1.5 (as recommended in the Value Engineering Report), but also the reminder to verify length of the basin by various numerical methods without recommending a particular length.

  It has to be highlited that the final length of the desander has not been defined yet, which has to be considered regarding construction progress of the effected structures. Especially the location of the access tunnel to the U/S gate chambers of the Desander as well as a streight part with a to be defined minimum lenght of the Intake Tunnel between the horizontal bend D/S of the Power Intake and the U/S trifurcation of the Desander to guarantee an equal flow distribution to each of the three U/S Connecting Tunnels of the Desander.
- The flow velocity in the design recommended by the reviwer is also well below 0.2 m/s. The desander basin length has been increased by 6% to 106 m when compared to Contractor design, but still reduced by 8% compared to original DJKV design of 115 m. Transition have been increased by 6 m to 30 m length.
- The OE agrees and supports replacing a physical model test with CFD.

Disclaimer:

Any approval will not release the Contractor from any of his obligations under the Contract. Despite the Engineer's approval the Contractor remains fully responsible for design, calculation, dimensioning, supply and installation without limitations.

Dr. Frank Negrassus/	Sebastian Beck, Chief Design Engineer